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Contents

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Foreword

The purpose of the *CDC Surveillance Summaries* is to make available the most current information on conditions of public health interest for which CDC has major responsibility. The *CDC Surveillance Summaries* are published quarterly and provide detailed analysis of the most current available data obtained for CDC surveillance programs. These reports complement other data published by CDC in the *Morbidity and Mortality Weekly Report (MMWR),* the *MMWR Annual Summary,* and various disease-surveillance reports. This volume contains epidemiologic information derived from surveillance forms, special investigations, and other sources of information collected at the state and national levels.

History of CDC Surveillance Activities

CDC has been actively involved in disease-surveillance activities since the formation of the Communicable Disease Center in 1946. The original scope of the National Surveillance Program included the study of malaria, murine typhus, smallpox, psittacosis, diphtheria, leprosy, and sylvatic plague. In 1954, a surveillance section was established within the Epidemiology Branch of CDC, primarily concerned with planning and conducting continuing surveillance and making periodic reports. National emergencies such as the Asian influenza pandemic and the discovery of Legionnaires' disease have prompted the involvement of CDC in new surveillance activities. Over the years the surveillance activities of CDC have expanded to include not only new areas in infectious disease but also programs in human reproduction, environmental health, chronic disease, risk reduction, and occupational safety and health. Ongoing evaluation of these programs has led to new methods of data collection and analysis and has prompted examination of how data are disseminated to the public health community.

In 1980 and 1981, a survey of CDC staff and state epidemiologists suggested that improved coordination of surveillance reports with the *MMWR* and the *MMWR Annual Summary* would facilitate timely publication; provide greater uniformity in the acquisition, evaluation, and reporting of surveillance data; and encourage use of these data. Several approaches to the development of a systematic process of disseminating disease-specific surveillance reports were considered. On the basis of considerations of timeliness, cost advantages, and editorial uniformity, a report published on a quarterly basis was recommended.

The *CDC Surveillance Summaries* contain information more reflective of the detailed surveillance reports of the past. CDC hopes that the *Surveillance Summaries* will disseminate surveillance data on a regular schedule, improve the clarity of community public health information, and also realize a cost savings. Although the *CDC Surveillance Summaries* are published quarterly, they will not be limited to quarterly data; annual data will probably be more typical. The *MMWR Annual Summary* will complement rather than serve as the cumulative summary of the quarterly publications.

Data Sources

Data on the reported occurrence of notifiable diseases are derived from reports supplied by the state and territorial departments of health and CDC program activities, routinely published in the *MMWR*, and compiled in final form in the *MMWR Annual Summary*.

CDC also maintains national surveillance programs for selected diseases with the cooperation of state and local health departments as well as other federal agencies, and publishes detailed epidemiologic analyses periodically. Data appearing in the *CDC Surveillance Summaries* or in a surveillance report may not agree exactly with reports published in the *MMWR* because of differences in timing of reports or because of refinements in case definition. It should be noted that data collected for the *MMWR* and the more detailed data published by individual CDC programs are collected independently.

These data should be interpreted with caution. Some diseases that cause severe clinical illness and are associated with serious consequences are probably reported quite accurately. However, diseases that are clinically mild and infrequently associated with serious consequences are less likely to be reported. Additionally, subclinical cases are seldom detected except in the course of epidemic investigations or special studies. The degree of completeness of reporting is also influenced by the diagnostic facilities available, the control measures in effect, and the interests and priorities of state and local officials responsible for disease control and surveillance. Finally, factors such as the introduction of new diagnostic tests and the discovery of new disease entities may cause changes in disease reporting independent of the true incidence of disease. Despite these limitations the data in these reports have proven to be useful in the analysis of trends.

Surveillance Programs
Centers for Disease Control

Surveillance program	Responsible branch	Most recent report/summary*
Abortion	Pregnancy Epidemiology Branch Division of Reproductive Health Center for Health Promotion and Education	1984, SS 33/3 (1981 data)
Behavioral risk factors	Division of Nutrition Center for Health Promotion and Education	1984, SS 33/1 (data from 1981-1983)
Beryllosis cohorts: registry of disease and exposure	Surveillance Branch Division of Surveillance, Hazard Evaluations, and Field Studies National Inst. for Occup. Safety & Hlth.	March 1983 (data from 1951-1980)
Biologics	Data Management Branch Division of Immunization Center for Prevention Services	Dec 1982 (1982 data)
Botulism	Enteric Diseases Branch Division of Bacterial Diseases Center for Infectious Diseases	May 1979 (data from 1899-1977)
Brucellosis	Bacterial Zoonoses Activity Division of Bacterial Diseases Center for Infectious Diseases	June 1979 (1978 data)
Coal workers' pneumoconiosis	Epidemiological Investigations Branch Division of Respiratory Disease Studies National Inst. for Occup. Safety & Hlth.	Feb 1983 (SS 32/1) (data from 1978-1980)
Congenital malformations	Birth Defects Branch Chronic Diseases Division Center for Environmental Health	Feb 1983 (SS 32/1) (data from 1970-1980)
Dengue	Dengue Branch Division of Vector-Borne Viral Diseases Center for Infectious Diseases	1984, SS 33/1 (1982 data)
Diabetes	Division of Diabetes Control Center for Prevention Services	June 1979 (1978 data)
Diphtheria	Surveillance, Investigations and Research Branch Division of Immunization Center for Prevention Services	July 1978 (data from 1971-1975)
Ectopic pregnancy	Pregnancy Epidemiology Branch Division of Reproductive Health Center for Health Promotion and Education	1984, SS 33/2 (data from 1979-1980)

*Publications denoted by "SS" appeared in issues of *CDC Surveillance Summaries*. Other reports listed can be obtained by contacting the responsible branch listed.

Surveillance Programs
Centers for Disease Control

Surveillance program	Responsible branch	Most recent report/summary*
Encephalitis	Arbovirus Reference Branch Division of Vector-Borne Viral Diseases Center for Infectious Diseases	May 1981 (1978 data)
Enterovirus	Respiratory and Enterovirus Branch Division of Viral Diseases Center for Infectious Diseases	Nov 1981 (data from 1970-1979)
Fifteen leading causes of death in the U.S., 1978	Health Analysis and Planning for Preventive Services Center for Prevention Services	Sept 1982 (1978 data)
Food-borne disease	Enteric Diseases Branch Division of Bacterial Diseases Center for Infectious Diseases	June 1983 (1981 data)
Gonorrhea	Division of Sexually Transmitted Diseases Center for Prevention Services	1984, SS 33/4 (data from 1983-1984)
Hepatitis	Hepatitis Branch Division of Viral Diseases Center for Infectious Diseases	Jan 1985 (data from 1982-1983)
Homicide	Violence Epidemiology Branch Office of the Director Center for Health Promotion and Education	May 1983 (SS 32/2) (data from 1970-1978)
Hysterectomy	Epidemiologic Studies Branch Division of Reproductive Health Center for Health Promotion and Education	Aug 1983 (SS 32/3) (data from 1979-1980)
Influenza	Influenza Branch Division of Viral Diseases Center for Infectious Diseases	July 1984 (data from 1983-1984)
Lead poisoning in workers	Surveillance Branch Division of Surveillance, Hazard Evaluations, and Field Studies National Inst. for Occup. Safety & Hlth.	April 1983 (data from 1976-1980)
Leprosy	Respiratory and Special Pathogens Branch Division of Bacterial Diseases Center for Infectious Diseases	April 1976 (data from 1971-1973)
Leptospirosis	Bacterial Zoonoses Activity Division of Bacterial Diseases Center for Infectious Diseases	Aug 1979 (1978 data)

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Surveillance Programs
Centers for Disease Control

Surveillance program	Responsible branch	Most recent report/summary*
Malaria	Malaria Branch Division of Parasitic Diseases Center for Infectious Diseases	Oct 1984 (1983 data)
Maternal mortality	Division of Reproductive Health Center for Health Promotion and Education	1984, SS 33/1 (data from 1974-1978)
Measles	Surveillance, Investigations and Research Branch Division of Immunization Center for Prevention Services	Sept 1982 (data from 1977-1981)
Mumps	Surveillance, Investigations and Research Branch Division of Immunization Center for Prevention Services	July 1978 (data from 1974-1976)
National electronic injury surveillance system	Safety Surveillance Branch Division of Safety Research National Inst. for Occup. Safety & Hlth.	May 1983 (SS 32/2) (1982 data)
National Occupational Hazard Survey (NOHS)	Surveillance Branch Division of Surveillance, Hazard Evaluations, and Field Studies National Inst. for Occup. Safety & Hlth.	NIOSH Technical Report DHHS (NIOSH) Pub. No. 83-117
Nosocomial infections	National Nosocomial Infections Study Hospital Infections Program Center for Infectious Diseases	1984, SS 33/2 (1983 data)
Nutrition	Division of Nutrition Center for Health Promotion and Education	Nov 1982 (1980 data)
Occupational characteristics of disabled workers	Surveillance Branch Division of Surveillance, Hazard Evaluations, and Field Studies National Inst. for Occup. Safety & Hlth.	July 1980 (data from 1969-1978)
Occupational injuries among loggers	Safety Surveillance Branch Division of Safety Research National Inst. for Occup. Safety & Hlth.	Aug 1983 (SS 32/3) (data from 1969-1974)
Occupational mortality in Washington State	Surveillance Branch Division of Surveillance, Hazard Evaluations, and Field Studies National Inst. for Occup. Safety & Hlth.	DHHS (NIOSH) Pub. No. 83-116 (data from 1950-1979)

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Surveillance Programs
Centers for Disease Control

Surveillance program	Responsible branch	Most recent report/summary*
Pediatric nutrition	Division of Nutrition Center for Health Promotion and Education	1983, SS 32/4 (1982 data)
Pelvic inflammatory disease	Division of Sexually Transmitted Disease Center for Prevention Services	1983, SS 32/4 (data from 1965-1982)
Plague	Plague Branch Division of Vector-Borne Viral Diseases Center for Infectious Diseases	1984, SS 33/1 (1983 data)
Poliomyelitis	Surveillance, Investigations and Research Branch Division of Immunization Center for Prevention Services	Dec 1982 (data from 1980-1981)
Psittacosis	Bacterial Zoonoses Activity Division of Bacterial Diseases Center for Infectious Diseases	Feb 1983 (SS 32/1) (1979 data)
Rabies	Viral and Rickettsial Zoonoses Branch Division of Viral Diseases Center for Infectious Diseases	Feb 1983 (SS 32/1) (1981 data)
Reye syndrome	Epidemiology Office Division of Viral Diseases Center for Infectious Diseases	1984, SS 33/3 (1983 data)
Rickettsial disease (RMSF, murine typhus, Q fever)	Viral and Rickettsial Zoonoses Branch Division of Viral Diseases Center for Infectious Diseases	May 1981 (1979 data)
Rocky mountain spotted fever	Viral and Rickettsial Zoonoses Branch Division of Viral Diseases Center for Infectious Diseases	1984, SS 33/3 (data from 1981-1983)
Rubella	Surveillance, Investigations and Research Branch Division of Immunization Center for Prevention Services	1984, SS 33/4 (1983 data)
Salmonella	Enteric Diseases Branch Division of Bacterial Diseases Center for Infectious Diseases	Dec 1982 (1980 data)

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Surveillance Programs
Centers for Disease Control

Surveillance program	Responsible branch	Most recent report/summary*
Sentinel health event (occupational) (SHE)	Surveillance Branch Division of Surveillance, Hazard Evaluations, and Field Studies National Inst. for Occup. Safety & Hlth.	Sept 1983
Summer mortality	Special Studies Branch Chronic Diseases Division Center for Environmental Health	Feb 1983 (SS 32/1) (data from 1979-1981)
Surgical sterilization	Epidemiologic Studies Branch Division of Reproductive Health Center for Health Promotion and Education	Aug 1983 (SS 32/3) (data from 1979-1980)
Toxic-shock syndrome	Respiratory and Special Pathogens Branch Division of Bacterial Diseases Center for Infectious Diseases	1984, SS 33/3 (data from 1960-1984)
Trichinosis	Helminthic Diseases Branch Division of Parasitic Diseases Center for Infectious Diseases	1984, SS 33/4 (1983 data)
Tuberculosis	Division of Tuberculosis Control Center for Prevention Services	March 1985 (1983 data) TB Statistics: States & Cities Nov 1983 (1980 data) TB in the United States
U.S. immunization survey	Surveillance, Investigations and Research Branch Division of Immunization Center for Prevention Services	April 1983 (data from 1979-1982)
Venereal disease	Division of Sexually Transmitted Disease Center for Prevention Services	(1980 data) Sexually Transmitted Diseases Statistical Letter-No. 130 (data from 1978-1979) STD Fact Sheet-Edition 35
Water-related disease outbreaks	Enteric Diseases Branch Division of Bacterial Diseases Center for Infectious Diseases	Sept 1984 (1983 data)

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Rubella and Congenital Rubella Surveillance, 1983

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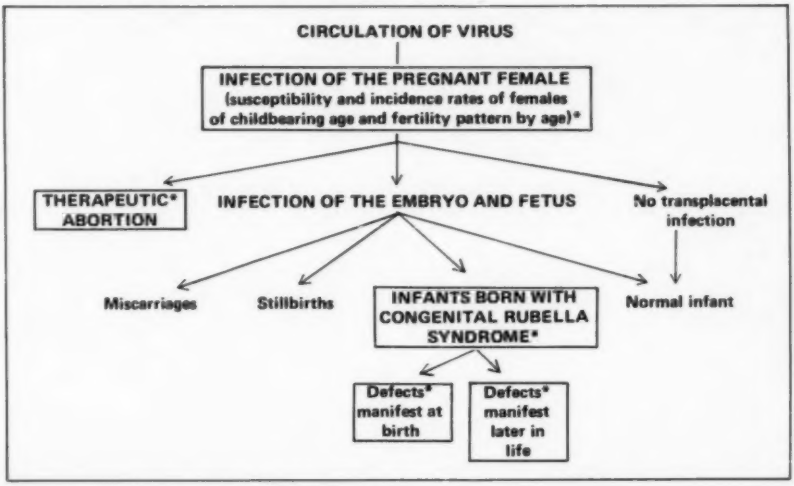
Introduction

Rubella was once a common exanthematous disease of childhood. By far the most important consequence of rubella is congenital rubella infection (CRI) especially during the first trimester of pregnancy. Intrauterine infection can result in abortions, miscarriages, stillbirths, and infants born with a variety of defects collectively termed the congenital rubella syndrome (CRS) (Figure 1). Although CRS has been estimated to occur among at least 20%-25% of infants born to women who acquire rubella during the first trimester of pregnancy, the actual risk of infection and subsequent defects may be considerably higher; one recent study found up to 80% of these infants to be affected (*1*). The risk of any defect occurring falls to approximately 10%-20% by the 16th week of pregnancy, with defects rarely resulting from infection beyond the 20th week. Inapparent maternal rubella infection can also result in malformation. Fetal infection without clinical stigmata of CRS can occur at any stage of pregnancy. Preventing fetal infection and consequent CRS is the objective of rubella immunization programs.

FIGURE 1. Factors influencing the occurrence and monitoring of congenital rubella infection (CRI) and congenital rubella syndrome (CRS)



*Potential monitoring points for the impact of CRI.

Rubella vaccines have been shown to be safe and highly effective, and to provide durable immunity (2). A single injection of live rubella virus vaccine produces a mild or inapparent, noncommunicable infection. Rubella antibodies develop in at least 95% of susceptible individuals who receive vaccine at 12 months of age or older. Evidence now extending through 15 years indicates that, although the titers of vaccine-induced antibodies are generally lower than those following natural disease, vaccine-induced immunity protects against both clinical illness and significant viremia after natural exposure. When adults who have failed to produce detectable hemagglutination-inhibition (HI) antibodies following vaccination have been examined more closely, almost all have had detectable antibody by a more sensitive test. Based on available follow-up studies, vaccine-induced protection is expected to be life-long.

Beginning in 1966, surveillance data on rubella were submitted as part of each State's weekly Telegraphic Report of Notifiable Diseases (reported weekly in MMWR's Tables I and III). Data on cases of CRS are available from the National Congenital Rubella Syndrome Registry (NCRSR) maintained at the Division of Immunization at CDC.

This summary updates previous reports on surveillance of acquired rubella and CRS in the United States. Information regarding the risks to the fetus following maternal rubella vaccination is also presented.

Methods

The Telegraphic Report of Notifiable Diseases is a passive reporting system and, as such, depends on suspected cases being reported to CDC through local and state health departments. These reports are case counts with no accompanying data and are tabulated by year of report. Because of the mild and transient nature of the disease and its similarity to many other rash illnesses, the degree of rubella disease underreporting and misdiagnosis is probably considerable. Definitive diagnosis may be made by a number of rubella-specific serological tests as well as by viral culture, but these tests are not required for reporting.

NCRSR data are obtained through reports from state and local health departments which contain clinical and laboratory information. The NCRSR monitors reports by year of birth, with cases classified into six categories, the most specific of which for clinical CRS cases are "confirmed" and "compatible" (C&C). As shown in Table 1, cases with both defects and laboratory evidence of rubella infection are designated as confirmed. Cases which satisfy only the clinical criteria of two complications from A or one from A and one from B, in the absence of laboratory confirmation, are designated as compatible. Since the NCRSR cases are classified by year of birth, data are considered provisional for any given year and are subject to updating because of delayed reporting.

Because of concerns about the possible risk of teratogenicity from live rubella vaccine, the CDC has maintained since 1971 a register of women vaccinated within 3 months before or 3 months after their presumed dates of conception. Data are obtained through reports from physicians and from state and local health departments, as well as directly from vaccinated women. These women were followed prospectively to monitor and quantitate the risks to the fetus following exposure to attenuated rubella vaccine virus.

Results

Rubella. In 1983, a final total of 970 cases of rubella (0.4 cases/100,000 population) were reported to CDC (3). This represents a decrease of 58% over the 1982 total of 2,325 cases and is the lowest number of cases reported since rubella became a nationally notifiable

disease in 1966 (Figure 2). The 1983 incidence rate represents a 54% decline over the previous all-time low noted in 1981 (Table 2). The 1983 total represents a 98% decline from 1969, the year of rubella vaccine licensure.

Thirteen states and the District of Columbia reported no rubella cases in 1983, compared with seven states and the District of Columbia in 1982. California (298 cases), Texas (117 cases), New York City (87 cases), and Florida (70 cases) accounted for 59% of the 1983 cases. California alone accounted for 31% of the cases for 1983, but experienced a 79% decrease from 1982 when it accounted for 62% of all U.S. cases (*4*). The number of counties reporting rubella continued to decline from 366 (11.7%) in 1982 to 284 (9.0%) in 1983.

The downward trend in rubella continued in 1984. Provisionally 745 cases of rubella were reported to CDC in 1984, a 23% decline from the 1983 figure. A total of 11 states and the District of Columbia had reported no cases of rubella.

Age. Long term data on the occurrence of rubella among specific age groups are available from Illinois, Massachusetts, and New York City. In the years before vaccine licensure, children had the greatest occurrence of rubella, with the highest incidence rate among those 5-9

TABLE 1. Criteria for classification of congenital rubella syndrome (CRS) cases

I. CRS CONFIRMED—Defects present and 1 or more of the following:
   A. Rubella virus isolated
   B. Rubella-specific IgM present
   C. Rubella hemagglutination-inhibition (HI) titer in the infant persisting above and beyond that expected from passive transfer of maternal antibody (i.e., rubella HI titer in the infant which does not fall off at the expected rate of one 2-fold dilution/month).

II. CRS COMPATIBLE—Laboratory data insufficient for confirmation and any 2 complications listed in A or 1 from A and 1 from B:
   A. Cataracts/congenital glaucoma (either or both count as 1), congenital heart disease, loss of hearing, pigmentary retinopathy.
   B. Purpura, splenomegaly, jaundice, microcephaly, mental retardation, meningoencephalitis, radiolucent bone disease.

III. CRS POSSIBLE—Some compatible clinical findings which do not fulfill the criteria for a compatible case.

IV. CONGENITAL RUBELLA INFECTION ONLY—No defects present but laboratory evidence of infection.

V. STILLBIRTHS—Stillbirths which are thought to be secondary to maternal rubella infection.

VI. NOT CRS—One or more of any of the following inconsistent laboratory findings in child without evidence of an immunodeficiency disease:
   A. Rubella HI titer absent in a child ≤24 months
   B. Rubella HI titer absent in mother
   C. Rubella HI titer decline in an infant consistent with the normal decline of passively transferred maternal antibody after birth (the expected rate of decline of maternal antibodies is one 2-fold dilution/month).

years of age (Table 3). Children <10 years of age accounted for 60.1% of the cases, while 22.9% of the total cases were reported among those ≥15 years of age. In the period 1975-1977, although incidence rates declined for all age groups, the greatest decreases occurred among persons <15 years of age. The highest incidence rates were now reported among 15-19 year olds rather than 5-9 year olds. Children <10 years of age accounted for only 24.0% of cases, while persons ≥15 years of age made up 62.1% of cases. From 1981 through 1983, persons ≥15 years of age accounted for only 37.7% of reported cases and had a 90% reduction in their risk of acquiring rubella relative to prevaccine years.

National data showed that compared with both 1981 and 1982, the 1983 age-specific incidence rates decreased for all ages (Table 2). Children <5 years of age continued to have the highest reported incidence rate (1.8 cases/100,000 population) and accounted for one-third of the 1983 cases with known age. The increase in incidence rate among persons ≥15 years of age that was noted from 1981 (0.4 cases/100,000 population) to 1982 (0.8

FIGURE 2. Rubella incidence, ten selected areas,* United States, 1928-1983

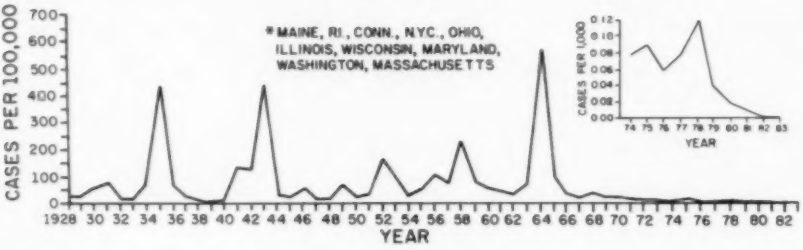


TABLE 2. Age distribution of reported rubella cases, and estimated incidence rates,* United States, 1981-1983

Age group (years)	1981			1982			1983			Percentage rate change
	No.	%	Rate	No.	%	Rate	No.	%	Rate	1981-1983
<1	287	17.1	9.9	177	8.5	5.4	127	15.0	4.0	-59.6
1-4	339	20.3	3.2	249	12.0	2.0	149	17.6	1.2	-62.5
5-9	277	16.5	2.1	214	10.3	1.5	102	12.1	0.7	-66.7
10-14	153	9.1	1.0	155	7.4	1.0	93	11.0	0.6	-40.0
15-19	210	12.5	1.3	288	13.8	1.6	95	11.2	0.6	-53.9
20-24	162	9.7	0.9	375	18.0	1.9	117	13.8	0.6	-33.3
25-29	102	6.1	0.6	298	14.3	1.6	83	9.8	0.5	-16.7
≥30	144	8.6	0.2	327	15.7	0.3	80	9.5	0.1	-50.0
Total known age	1,674	80.6	-	2,083	89.6	-	846	87.2	-	-
Total unknown age	403	19.4	-	242	10.4	-	124	12.8	-	-
Total	2,077	100.0	0.9	2,325	100.0	1.0	970	100.0	0.4	-54.2

*Incidence rate=cases/100,000 population (projected census data) extrapolated from the age distribution of cases with known age.

cases/100,000 population) was reversed in 1983 (0.2 cases/100,000 population). This age group accounted for 44.3% of cases with known age in 1983 compared with 61.8% in 1982.

Congenital Rubella Syndrome (CRS). After some initial decreases in the years immediaty following licensure of rubella vaccine, the reported incidence rates of CRS stabilized (Table 4, Figure 3). Between 1969 and 1972, incidence rates of C&C cases reported to the NCRSR declined from 1.7 to 1.0 cases/100,000 live births, representing a decline from 62 cases/year to approximately 30 cases/year. An increase in CRS cases in 1979 reflects the outcome of

TABLE 3. Age distribution and incidence rates* of reported rubella cases,† Illinois, Massachusetts, and New York City, 1966-1968,§ 1975-1977,§ and 1981-1983§

Age group (years)	1966-1968¶			1975-1977			1981-1983**			Percentage rate change
	No.	%	Rate	No.	%	Rate	No.	%	Rate	1966-1983
<5	1,294	21.6	63.3	160	9.8	9.8	41	26.6	2.5	-96.0
5-9	2,304	38.5	101.3	233	14.2	11.6	37	24.0	2.2	-97.8
10-14	1,020	17.0	44.0	229	13.9	11.2	18	11.6	0.9	-97.8
15-19	759	12.7	35.7	634	38.7	27.4	14	9.1	0.6	-98.2
≥20	601	10.2	3.7	384	23.4	2.3	44	28.6	0.3	-92.9
Total	5,987	100.0	24.3	1,640	100.0	6.7	154	99.9	0.6	-97.4

*Reported number of cases/100,000 population.

†Cases of unknown age excluded.

§Average annual figures over three-year period.

¶Represents prevaccine years.

**These selected data accurately reflect changes using total U.S. data. 1980 population data used.

TABLE 4. Incidence rate of congenital rubella syndrome (CRS) reported to the National Congenital Rubella Syndrome Registry (NCRSR),* United States, 1969-1983

Year	NCRSR No.	Incidence rate†
1969	62	1.7
1970	68	1.8
1971	44	1.2
1972	32	1.0
1973	30	1.0
1974	22	0.7
1975	32	1.0
1976	23	0.7
1977	29	0.9
1978	30	0.9
1979	57	1.6
1980	14	0.4
1981	10	0.3
1982	11	0.3
1983	6	0.2

*Confirmed and compatible cases only, reported by year of birth. Data are provisional because of delayed reporting.

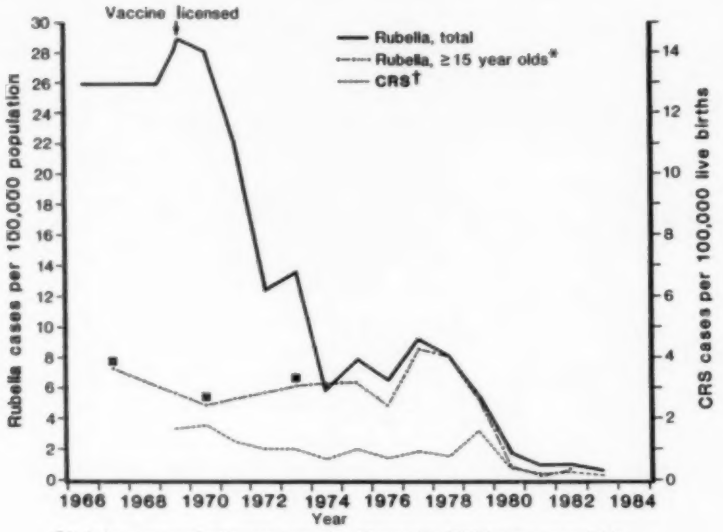
†Cases/100,000 live births, rounded off to one figure.

outbreaks of acquired rubella in 1978. Since 1981 there have been fewer than 11 cases reported annually, representing record low levels.

The recent declines in incidence rates of CRS recorded by the NCRSR parallel the decline in the overall incidence rate of acquired rubella and, more specifically, in the incidence rate for persons 15 years of age and older (Figure 3). Between 1979 and 1983, the reported incidence rate of rubella for this age group declined from 4.8 cases/100,000 population to 0.2 cases/100,000 population, a 96% decline. Similarly, there was a 90% decline in the reported incidence rate of C&C cases over this period. Based on the most recent C&C CRS data, the incidence rate of CRS reported in the United States has declined by 88% between 1969 (the first year of reporting) and 1983 (Table 4).

Rubella Vaccine during Pregnancy. As of December 31, 1983, data were available for 119 susceptible mothers who were vaccinated with RA 27/3 vaccine within 3 months of conception (Table 5) (*5*). None of their 121 infants had defects compatible with CRS. Two infants had asymptomatic glandular hypospadias, but both had negative rubella-specific IgM titers (< 1:4) in cord blood at birth. Four infants born without defects had serologic evidence of intrauterine infection. Follow-up, from 18 months to 7 years, indicates that these infants have grown and developed normally.

FIGURE 3. Incidence rate of reported rubella cases, and congenital rubella cases, United States, 1966-1983



* Includes proration of unknown age cases in ≥15 year olds. 1983 data are not available.

† Rate per 10^5 births of confirmed and compatible cases of CRS by year of birth. Reporting for recent years is provisional, as cases may not be diagnosed until later in childhood.

■ Average annual United States estimate based on data from Illinois, Massachusetts, and New York City for the 3-year periods 1966–1968, 1969–1971, and 1972–1974. Age-specific data were not available for U.S. totals until 1975.

Data from the same time period show that rubella virus has been isolated from the products of conception in one (3.1%) of 32 susceptible women having a spontaneous or induced abortion after receipt of vaccine (19 cases reported to CDC and 13 from the literature) (*6-8*).

So far there have been no cases of CRS reported following rubella vaccination. However, the theoretical maximum risk for the occurrence of CRS in the previously mentioned group of 121 children, based on the 95% confidence limits of the binomial distribution, may be as high as 3%. If 95 infants exposed to Cendehill and HPV-77 rubella vaccines are included, the maximum theoretical risk is 1.7%. This overall maximum risk remains far less than the 20% or greater risk of CRS associated with maternal infection with wild rubella virus during the first trimester of pregnancy (*9*) and is no greater than the 4-5% rate of birth defects in the absence of exposure to rubella vaccine (*10,11*).

Discussion

The United States immunization strategy adopted in 1969 was directed primarily towards pre-school and school-age children. The distribution of over 123 million doses of rubella vaccine since 1969 has resulted in reported rubella incidence rates that are at an all-time low and produced a significant change in the occurrence and epidemiologic characteristics of rubella in the United States. The periodic 6-9 year cycles of rubella epidemics no longer occur (Figure 2). Although the occurrence of reported rubella has fluctuated slightly over the past several years, it has done so at a level far below prevaccine levels. However, the potential for increased rubella activity in older individuals still exists. Groups requiring particular attention are older susceptible school-aged children and women of childbearing age. The rubella susceptibility rate in adolescents and young adults continues to be 10-20% (*12*). This potential for increases in rubella cases was recently demonstrated when outbreaks in postpubertal populations in universities, hospitals and other places of employment resulted in a 12% increase in acquired rubella reported between 1981 (which had been a record low year) and 1982 (Table 2). The problem is not due to a failure of the vaccine but rather to a failure of people to be vaccinated. Vaccinating these individuals will be difficult since there is no one approach that can reach all susceptible postpubertal individuals, particularly females who are no longer in school. Consequently, a multifaceted approach will be required involving both the private and public sectors. This approach should include postpartum and postabortion vaccination, follow-up vaccination of susceptibles identified through premarital and prenatal screening, and other efforts aimed at delivering vaccine to hard-to-reach populations. Requiring proof of immunity to both measles and rubella as a condition for college entry can minimize the risk of

TABLE 5. Pregnancy outcomes for 555 recipients of RA 27/3 vaccine, United States, January 1, 1979-December 31, 1983

Prevaccination immunity status	Total women	Live births	Spontaneous abortions and stillbirths	Induced abortions	Outcome unknown
Susceptible	157	121*	3	25	10
Immune	30	28	1	0	1
Unknown	368	310†	8	23	28
Total	555	459	12	48	39

*Includes two twin births.

†Includes one twin birth.

rubella outbreaks in this population. Enforcement of school immunization laws will be necessary to ensure continued success in the future. Physicians and other health care personnel must be willing to offer rubella vaccine whenever they encounter a potentially susceptible woman lacking contraindications for vaccination.

One of the impediments to vaccinating susceptible postpubertal females has been the fear that some may be pregnant or may become pregnant shortly after vaccination and that the vaccine virus might be teratogenic. Data collected through CDC indicate that the risk of CRI or CRS following rubella vaccination is minimal. The Immunization Practices Advisory Committee (ACIP) has stated that the risk of vaccine-associated defects is so small as to be negligible, and that vaccination during pregnancy should not ordinarily be a reason to consider interruption of pregnancy (*2*). A final decision about interruption of pregnancy must rest with the individual patient and her physician. Rubella vaccine is contraindicated during pregnancy. Reasonable precautions should be taken to preclude vaccination of pregnant women, including asking women if they are pregnant, excluding those who say they are, and explaining the theoretical risks to the others.

The most important indicator of the success or failure of rubella immunization programs is the reported occurrence of CRI. CRS represents the most serious outcome in terms of health cost burden. Costs for the lifetime care of an infant with CRS have recently been estimated to be in excess of $200,000 (*13*). CDC estimates of CRS incidence rates are derived primarily from the NCRSR reporting system, a passive reporting system. Passive surveillance by its nature results in underreporting of actual disease incidence. One indication of underreporting is the early age at which cases reported to CDC are diagnosed. Of the 470 NCRSR C&C infants, the age at diagnosis is known for 381. Of these, 247 (65%) were diagnosed within the first month of life, and only 24 (6%) after 1 year of age. Infants with severe and obvious CRS (e.g., cardiac or eye defects) are recognized and reported early in life and are most likely to be classified C&C, while those with mild CRS (e.g., mental or auditory defects) are often not reported until later in life, if at all. On average, 79% of all cases reported to the NCRSR are C&C (Table 4). In contrast, the mild cases, which probably represent more than half of all CRS cases, are often not reported to CDC (*14-16*). An analysis of the NCRSR C&C cases using a capture-recapture statistical model, suggests that only 1/5 of all C&C cases are reported to CDC. Thus, only about 1/10 (1/2 x 1/5) of all CRS cases are probably reported through the NCRSR (*17*).

Although passive reporting of rubella cases is incomplete, it can provide reliable information on trends and hence on the effectiveness of disease control efforts. In addition to monitoring the occurrence of rubella and CRS, surveillance of rubella has 3 other purposes: 1) to define individuals and populations in need of vaccination and provide information for formulating vaccination strategies, 2) to measure the health impact of rubella and provide a basis for evaluating program successes and failures and 3) to evaluate vaccine efficacy, duration of vaccine-induced immunity, and other issues related to vaccine safety and efficacy. The fact that the reported incidence rate of CRS has paralleled reported rubella in postpubertal populations (based on data for the ≥15 year age group), suggests that the decline in CRS between 1979 and 1983 is real. In addition, even though the absence of abortion monitoring makes it impossible to completely separate the impact of vaccination from the impact of abortion on the lowered CRS incidence rate, the fact that rubella and CRS have decreased together at a time when abortion availability has not increased suggests that vaccination has made the greater contribution to the recent declines.

Surveillance of acquired rubella is complicated by the fact that the clinical disease can be confused with a number of other illnesses. Thus, there is a need for laboratory confirmation of

cases, particularly in non-outbreak settings. In addition, if rubella continues to decrease as a result of effective vaccination programs, active surveillance strategies may become necessary to monitor trends more accurately.

Surveillance of CRS will also have to be intensified to monitor further reduction in morbidity. Surveillance of CRS is made difficult by several factors. Since CRS is now uncommon and is most characteristic only in its severest form, small differences in sensitivity and specificity of case ascertainment from year to year can lead to major differences in reported incidence rates. Nevertheless, surveillance of the severe sequelae of rubella can: 1) provide information on the characteristics of mothers who give birth to babies with CRS, 2) help define groups in greatest need of vaccination, and 3) provide important data on long term trends and program progress.

The available data indicate that CRS is now at record or close to record low levels. Given the probable degree of underreporting, however, there is still a substantial health cost burden in the United States that can be avoided (*18*). It will take 10-30 years before the immune cohort of vaccinated schoolchildren will comprise the childbearing age-group and CRS will disappear from this country. Until this process is complete, infants with CRS will continue to be born, and the other currently unmeasured outcomes of maternal rubella infection, i.e. miscarriages, stillbirths and abortions, will continue to occur. The elimination of CRS can be hastened, but this will require intensified efforts similar to those in the measles elimination effort, to: 1) achieve and maintain high levels of immunization, 2) enhance surveillance of rubella and CRS, and 3) institute prompt outbreak control measures once rubella is detected in a community. Aggressive response to outbreaks may interrupt chains of transmission and will increase immunization levels among persons who might otherwise not be vaccinated. Methods for controlling rubella outbreaks are evolving. The major strategy will be to define target populations, ensure that they are vaccinated rapidly, and maintain active surveillance so that control measures can be modified if the situation changes.

Many of the necessary CRS elimination efforts are already being implemented to some degree as a result of the measles elimination effort. Thus major new expenditures of time and money are not necessary. With a diverse yet concerted effort we can eliminate the financial and emotional burden of CRS years before its expected demise.

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Changing Trends in Gonococcal Antibiotic Resistance in the United States, 1983-1984

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Introduction

Antibiotic resistance in *Neisseria gonorrhoeae* developed rapidly following the introduction of penicillin more than 40 years ago (*1,2*). With the emergence of penicillinase-producing *N. gonorrhoeae* (PPNG) in the United States (*3*), as well as worldwide (*4*) during 1976, resistance in the gonococcus was recognized to be multifaceted. With the availability of a rapid laboratory screening test for beta lactamase (penicillinase), PPNG screening was possible in the United States. Strain and case interview information determined that during 1976 and 1977, most PPNG cases in the United States were largely a result of importation from Southeast Asia or Africa (*5,6*). By 1980, more than half of PPNG cases were linked to endemic transmission rather than importation (*7*).

While levels of PPNG generally stabilized during 1983, higher level antibiotic resistance was recognized as chromosomally-mediated resistance in *N. gonorrhoeae* (CMRNG) due to an outbreak in North Carolina (*8*). Since the North Carolina outbreak, more than 20 states have reported cases to CDC and have submitted gonococcal isolates for confirmation of resistance to penicillin (*9*).

Increased recognition of cases and prompt reporting are extremely important for the success of surveillance and control efforts. In this report we describe the results of strain surveillance and laboratory-based reporting of CMRNG cases to CDC during 1983-1984 from 23 states that initiated screening for CMRNG at the regional or state laboratory levels.

Surveillance Methods

Between February 1983 and September 1984, 23 states reported cases of CMRNG infections to CDC and submitted isolates for confirmation of resistance to penicillin. No data were available from the other 27 states that either do not screen for CMRNG or initiated screening after September 1984.

The reported cases of CMRNG infections generally represented cases detected by clinical failure to a primary treatment regimen of penicillin or ampicillin. Clinical and epidemiologic data obtained on cases included information on sex and sexual preference.

Case Definition and Detection. Cases were defined as persons infected by a non beta-lactamase-producing strain of *N. gonorrhoeae* which grew on media containing either 1.5-1.6 μg/ml of penicillin or exhibited a zone of growth inhibition of less than 26 mm around a 10 unit penicillin disk. All cases were detected by these screening methods for penicillin resistance at the local or state laboratories.

Laboratory Methods for Antimicrobial Susceptibility Testing. *N. gonorrhoeae* isolates which grew on media containing 1.5-1.6 μg of penicillin/ml. or produced a zone of inhibition of less than 26 mm. around a 10 unit penicillin disk were submitted to CDC for confirmation of resistance. Isolates were identified as *N. gonorrhoeae* by the CDC laboratory by accepted methods. Minimum inhibitory concentrations were determined by the agar dilution method (*10*) for 11 antimicrobials which included ampicillin, kanamycin, penicillin, tetracycline, erythromycin, spectinomycin, cefoxitin, trimethoprim-sulfamethoxazole, cefuroxime, thiamphenicol, and cefotaxime. CMRNG isolates were also typed using serological methods (*11,12*) and auxotyped (*13*) to provide phenotypic data for strain subtyping and surveillance.

Antimicrobial susceptibilities for the CMRNG isolates collected in 1983-1984 were compared to susceptibilities for 450 *N. gonorrhoeae* isolates obtained from The National Gonorrhea Therapy Monitoring Study (1972-1975) (*14,15*) in the United States. Differences in susceptibility were examined by binomial distribution and Chi Square analysis.

Results

CMRNG Case Distribution in the United States. A total of 446 cases of CMRNG infections were reported to CDC by the end of September 1984 (Figure 1). The sex and sexual preference were known for more than 90% of the reported cases. The majority of these cases were detected as primary treatment failures to regimens of ampicillin or penicillin. Less than

FIGURE 1. Cases of chromosomally resistant *Neisseria gonorrhoeae*, United States, 1983-1984*

*Reflects total CMRNG cases reported between February 1983 and the end of September 1984, not the number of isolates submitted to CDC for confirmation of resistance.

20% of cases had received a tetracycline or dual ampicillin-tetracycline treatment regimen. CMRNG isolates were submitted for 175 (39%) of the 446 reported cases. Cases included homosexual men and heterosexual men and women. At least 30% of the cases were homosexual men primarily reported from New Mexico and Oregon. Less than 1% of all cases reported a history of foreign travel within 60 days of the gonococcal infection and < 5% were linked to female prostitute transmission.

Five states reported 10 or more cases of CMRNG during the 20 month period. North Carolina reported 261 cases which largely involved heterosexual transmission. Based on patient interview and sexual partner information cases in North Carolina were generally limited to spread within that state. Like North Carolina, Tennessee reported a total of 15 cases involving heterosexual transmission linked primarily to intrastate sexual partner contact. Thirty-two cases were reported from the state of Washington. Twenty-four (75%) were heterosexual cases; 8 (25%) were homosexual men.

CMRNG transmission in New Mexico and Oregon was different. Of the 60 cases reported from New Mexico, 28 (47%) were homosexual men and 3 (5%) were bisexual men. Based on all patient interview records and gonococcal strain typing at least two separate outbreaks were detected in New Mexico within the homosexual male population. Although patient interview data failed to link cases between homosexuals and heterosexuals by other sources of transmission such as bisexual men, gonococcal strain typing suggested that one of the strain types detected may have infected both heterosexual and homosexual cases by a common sexual source. In Oregon, each of the 10 cases were homosexual men. Two clusters of CMRNG infection possibly linked to a different source were detected using patient interview and sexual partner information in conjunction with gonococcal strain typing.

Patterns of Antimicrobial Resistance due to CMRNG. Seventy-five percent of the CMRNG isolates required ⩾ 2 μg/ml of penicillin for growth inhibition and 86.0% required at least 1 μg/ml of penicillin. Eighty-seven percent required at least 2 μg/ml of tetracycline, and 98.0% required at least 1 μg/ml of tetracycline. Increased resistance to trimethoprim-sulfamthoxazole, erythromycin, and cefoxitin was also detected in at least 50% of the CMRNG isolates submitted to CDC. Eighty percent of all CMRNG isolates submitted to CDC belonged to similar gonococcal serological and auxotype subtypes; the most common serological subtype was IB-1 and the majority of isolates were proline or prototrophic auxotypes.

For purposes of comparison, CMRNG were significantly more resistant to both penicillin and tetracycline than previously-tested *N. gonorrhoeae* isolates obtained from The Therapy Monitoring Study ($p<0.01$). Seventy-five percent of the CMRNG isolates required ⩾2.0 μg/ml of penicillin for growth inhibition compared to only 0.2 percent of isolates from The National Gonorrhea Therapy Monitoring Program (Tables 1 and 2). Likewise, 87% of CMRNG isolates required more than 2.0 μg/ml of tetracycline compared to only 12% of isolates obtained from Therapy Monitoring (Tables 1 and 2).

Discussion

These data represent reporting of cases from 23 states which were screening gonococcal isolates for resistance due to CMRNG. Because all states do not screen for CMRNG, the prevalence of these infections in the United States is not known at this time. While screening for CMRNG in selected states may introduce artifacts in surveillance and reporting, the clustering of homosexual male cases in New Mexico and Oregon may be real based on 1) apparent differences in transmission of CMRNG within heterosexual and homosexual populations, and 2) endemic propagation of a more-resistant *N. gonorrhoeae* strain subtype within

certain communities. The clustering in homosexual men that occurred in these two states may represent variations in sexual practices and sustained transmission of a more-resistant strain among common sexual partners. New York and California have larger homosexual male populations but did not report clustering of CMRNG. New York, however, was not screening for CMRNG. CMRNG cases may result from the introduction of relatively more resistant organisms into a community, acquisition of resistance by some strains in the community, or selection of relatively more resistant organisms already endemic in certain populations. Unlike PPNG, case interview and sexual partner information have linked few CMRNG cases to interstate transmission or foreign travel.

TABLE 1. Susceptibility of chromosomally resistant *Neisseria gonorrhoeae* to 10 antimicrobial agents

Antimicrobial agent	Number of strains with MIC (μg/ml) of												
	≤0.015	0.03	0.06	0.125	0.25	0.5	1.0	2.0	4.0	8.0	12.0	16.0	≥32.0
Penicillin	-	-	-	1	8	17	20	91	34	4	-	-	-
Tetracycline	-	-	-	-	1	3	19	42	93	17	-	-	-
Erythromycin	-	-	1	3	11	56	72	25	7	-	-	-	-
Cefoxitin	-	-	-	-	-	10	25	92	32	16	-	-	-
Cefuroxime	1	6	9	30	60	44	20	3	2	-	-	-	-
Cefotaxime	38	27	53	42	15	-	-	-	-	-	-	-	-
Spectinomycin	-	-	-	-	-	-	-	-	-	45	80	45	5
Kanamycin	-	-	-	-	-	-	-	-	-	14	-	132	29
Thiamphenicol	-	-	-	-	28	33	87	22	5	-	-	-	-
Sulfamethoxazole-trimethoprim*	-	-	3	5	59	69	36	3	-	-	-	-	-
Total number of CMRNG isolates = 175													

*Sulfamethoxazole:trimethoprim given as 19:1 combination, MIC represents trimethoprim concentration.

TABLE 2. Ranges of minimum inhibitory concentrations for six antimicrobial agents for gonococcal isolates obtained from The National Gonorrhea Therapy Monitoring Program, 1972-1975

	Percentage of isolates susceptible to an MIC (μg/ml) of:							
	≤0.12	0.25-0.5	1.0	2.0	4.0	8.0	16.0	≥
Penicillin	63.2	31.7	4.9	0.2	-	-	-	-
Tetracycline	4.9	57.7	25.2	10.6	1.6	-	-	-
Erythromycin	25.6	66.2	5.9	2.3	-	-	-	-
Cefuroxime	91.6	6.8	0.8	(0.8)*	-	-	-	-
Spectinomycin	-	-	-	-	0.5	32.1	66.7	0.7
Sulfamethoxazole-trimethoprim†	23.4	67.4	9.0	0.2	-	-	-	-
Total number of isolates = 450								

*Percentage of isolates exceeding the preceding concentration.

†Sulfamethoxazole:trimethoprim in a 19:1 combination, MIC represents trimethoprim concentration.

The CMRNG isolates tested were substantially more resistant to several therapeutically-useful antimicrobials than were isolates of *N. gonorrhoeae* occurring in the United States between 1972-1975. This has important implications for gonorrhea surveillance, control, and treatment recommendations.

In an effort to improve surveillance of CMRNG and monitor gonococcal antibiotic resistance, CDC has urged that screening for CMRNG be added to beta lactamase testing that is performed for PPNG (*9,16*). Constant monitoring of local and state treatment failure rates will support surveillance and control efforts for both CMRNG and PPNG.

Tetracycline regimens should not be used to retreat primary penicillin or ampicillin therapeutic failures due to CMRNG or to PPNG. With respect to current treatment guidelines, the drugs and dosages recommended for PPNG should be used to treat CMRNG (*17*). Until more clinical treatment data are available for CMRNG infections, spectinomycin should remain the drug-of-choice for the therapy of patients and their immediate sexual partners who may be infected by strains of CMRNG.

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Trichinosis Surveillance, 1983

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Introduction

Trichinella spiralis was first noted to be pathogenic for humans in 1859 (*1*). At the turn of the century, scattered reports in the medical literature described numerous outbreaks of trichinosis in the United States totaling hundreds of cases. In 1947, when the U.S. Public Health Service began collecting statistics on trichinosis at the national level, 400-450 cases were reported annually. In ensuing years, a gradual decline in cases occurred, reflecting the enactment of laws (such as prohibition of feeding uncooked garbage to pigs) designed to prevent vesicular exanthema of swine and swine cholera (*2*). In 1965, trichinosis became a reportable disease, with states requested to inform the National Morbidity Reporting Service of new cases of trichinosis on a weekly basis. Over the last ten years, the average incidence of trichinosis has stabilized at 100-150 cases annually, with peak years (such as 1969 and 1975) coinciding with the occurrence of large common-source outbreaks (*3*) (Figure 1). In 1983,

FIGURE 1. Reported trichinosis cases, United States, 1950-1983

thirty cases of trichinosis were reported in the United States, by far the lowest number recorded since the Public Health Service began collecting statistics. This report details characteristics of these 30 cases.

Materials and Methods

State Health Departments report new cases of trichinosis weekly to the National Morbidity Reporting Service. Supplemental epidemiologic information is submitted by the reporting state on Surveillance Case Report Forms (CDC 54.7, Rev. 7-81) to the Division of Parasitic Diseases (DPD), Center for Infectious Diseases (CID), CDC. Additional cases are identified through trichinosis serologic testing performed by the Helminthic Diseases Branch Serology Laboratory, DPD, CID, CDC, and also through investigations conducted by the staff of DPD, CID, CDC.

Criteria for inclusion as a case are:

1) *Trichinella*-positive muscle biopsy with signs and symptoms compatible with trichinosis including eosinophilia, fever, myalgia, and periorbital edema,
2) serology positive for trichinosis, or
3) compatible signs and symptoms in a patient with history of ingestion of meat known to contain *Trichinella* larvae.

Cases reported by the states but not characterized by written surveillance reports or not fitting the case definition are not included in this report.

Results

In 1983, 30 cases of trichinosis were reported to the CDC from 11 states. Three common-source outbreaks were identified, each involving only two cases. No deaths due to trichinosis were reported; all patients recovered from their illness. Eleven states reported at least one case; however, 73.3% of the cases occurred in five states (Connecticut, New Jersey, New York, Pennsylvania, and Texas) (Table 1). New Jersey reported the most cases (*9*) as well as the highest incidence (1.2 cases/1,000,000 population). The states with the highest mean annual trichinosis incidence for the 5-year period from 1979 through 1983 were Alaska (30.5/1,000,000), Rhode Island (8.4), Connecticut (3.5), New Jersey (3.0), Louisiana (2.4), and Vermont (2.0). Moderately high mean incidence was reported in Hawaii (1.5) and Massachusetts (1.2) (Figure 2). No cases were reported during this five-year period in Arkansas,

TABLE 1. Trichinosis cases by state, United States, 1983

State	Cases	Rate/million population*
Connecticut	3	1.0
Hawaii	1	1.0
Louisiana	2	0.5
Maryland	1	0.2
Massachusetts	1	0.2
New Jersey	9	1.2
New York	3	0.2
North Carolina	2	0.3
Pennsylvania	4	0.3
Texas	3	0.2
West Virginia	1	0.5

*Estimates of state populations as of April 1, 1980.

Source: U.S. Bureau of the Census, Statistical Abstract of the United States: 1984.

Florida, Georgia, Iowa, Kentucky, Michigan, Minnesota, Mississippi, Montana, Nebraska, Nevada, North Dakota, Oklahoma, South Dakota, Tennessee, Utah, or Wyoming. The remaining states reported between 0.1 and 1.0 cases/1,000,000 population.

Of the 30 cases reported in 1983, 16 (53.3%) occurred in males and 14 (46.7%) in females. The mean age was 35.5 years, with a range of 12-68 years. Age distribution was similar for both sexes (Figure 3), with a mean age of 33.6 years for males and 37.7 years for females.

Cases were fairly evenly distributed throughout the year (Figure 4). No peaking during the holiday months was evident as in previous years.

The infective meat item was identified for 27 cases; in only two cases was the suspect meat item examined for trichinae cysts. Pork was incriminated in 25 (92.6%) of the 27 cases. Two cases resulted from consumption of wild boar meat; the remainder from the ingestion of domestic pork. Sausage was the most frequently implicated form of pork (48.1% of cases). Among non-pork associated cases, ground beef was identified as the probable source of infection in one case and "shishkabob" in another (Table 2). The method of preparation of the incriminated meat was identified for 28 cases; in 16 (57%) of these, the meat was raw or inadequately cooked. Twenty-two patients (75.8% of those reporting a source) obtained the implicated meat from a supermarket or butcher shop. Two patients ate the incriminated meat at a restaurant and two obtained it directly from a private farm (Table 3).

FIGURE 2. Trichinosis mean annual incidence rate per 1,000,000 population, by state, United States, 1979-1983

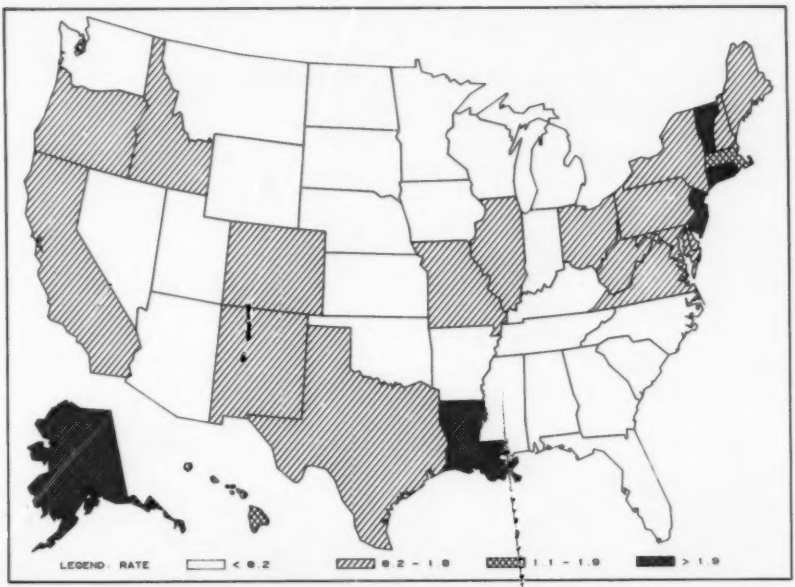


FIGURE 3. Trichinosis, by age and sex, United States, 1983

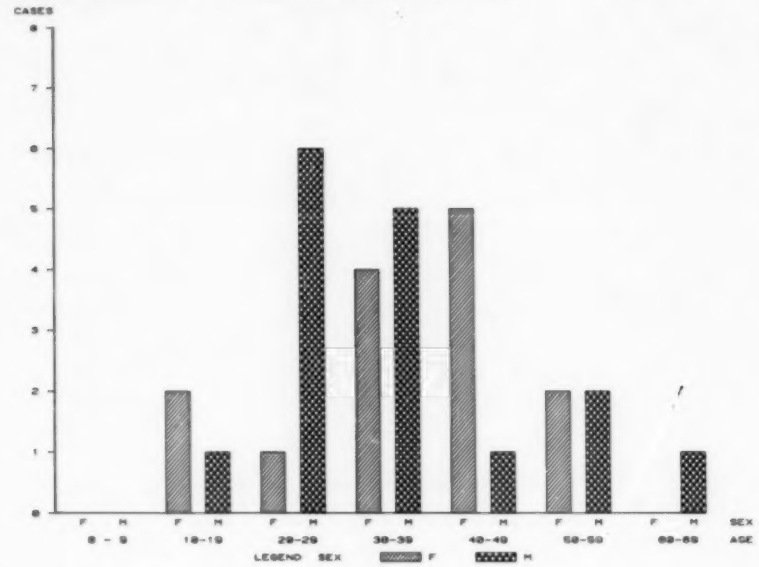
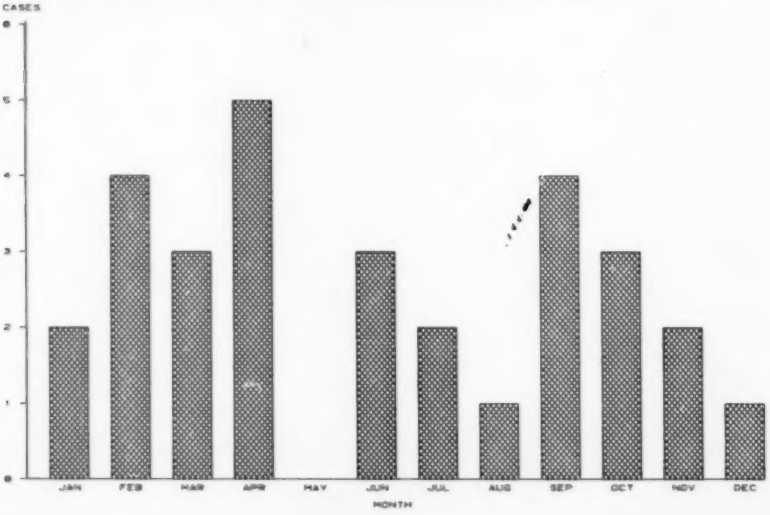


FIGURE 4. Trichinosis cases, by month of onset, United States, 1983



All patients had at least one sign or symptom. The following clinical characteristics were reported: 100% had fever (28 of 28 cases for whom this symptom was known), 89% had periorbital edema (25 of 28 cases), 96% had myalgia (27 of 28 cases), and 96% had eosinophilia (26 of 27 cases). The incubation period was determined for the 20 cases in which the dates for consumption of incriminated meat and onset of symptoms were available. The mean incubation period was 10.8 days with a range of 1-21 days. Of the 24 patients who had serologic tests for trichinosis, 20 were positive (83%). Muscle biopsies were performed on 16 patients: 12 were positive (75%). Two patients had neither muscle biopsy or serology (Table 4).

Discussion

The 30 cases of trichinosis reported in 1983 are well below the average 100-150 cases reported annually over the past ten years. Certain limitations must be considered in interpreting these data. The surveillance system for trichinosis is passive and relies on the primary physician to report cases. Physicians frequently do not report cases or are unaware of the diseases which are classified as reportable (*4,5*). In addition, probably only severe cases are

TABLE 2. Trichinosis cases, by source of infection, United States, 1983

Food	Cases
Pork (Total)	25
Wild boar	2
Sausage	13
Chops	3
Roast	2
Other	3
Unspecified	2
Hamburger	1
Nonpork other	1
Unknown	3
Total	30

TABLE 3. Trichinosis cases, by source of meat, United States, 1983

Source	Cases
Supermarket-butcher shop or other commercial outlet	22
Restaurant or other public eating place	2
Direct from farm	2
Hunted or trapped	1
Other	2
Unknown	1
Total	**30**

seen by physicians; asymptomatic or mildly symptomatic cases go undetected unless related epidemiologically to a more severe case during an investigation. Studies by Zimmerman and others in 1973 suggest that most cases do go undetected (*6*) During the period 1966-1970, 8,071 human diaphragms obtained from 42 states and the District of Columbia were examined for larvae of *Trichinella* sp. Of these, 4.2% were found to have been infected with *Trichinella* larva (either live of dead), and 0.58% were infected with live larva (suggesting recent infection). Adjusted for the age structure of the U.S. population, these figures suggest that an estimated 1,490,000 people (0.73% of the population) were infected with live larva during the 1966-1970 study. If one estimates the average life span of the larva to be 5-10 years, this would suggest an annual incidence of 150,000-300,000 during this period. This number contrasts greatly with the 100-200 cases reported annually between 1966 and 1970. Consequently, the surveillance system lacks high sensitivity. With a stable reporting procedure, however, the reported cases indicate a trend in trichinosis incidence. No apparent changes in the reporting process can account for the 1983 decline in reported trichinosis cases.

The decline in trichinosis cases may have resulted in part from the small number of multiple case outbreaks in 1983. In past years, the majority of cases have been associated with common-source outbreaks with years of peak incidence, such as 1969 and 1975, coinciding with an unusually large number of such cases (*3, 7*). In 1983, only six cases were associated with three common sources. The decline in cases reported may also be a reflection of the decreased intensity of infection. That is, when fewer trichinae are ingested cases are more likely to be asymptomatic or mildly symptomatic and may go undetected (*8*).

The decline in cases does not reflect known active disease control. There are government guidelines requiring that processed ("ready-to-eat") pork products be treated to destroy *Trichinella*, ensuring that these items may be safely eaten without further cooking (*9, 10*). As in previous years, however, no specific federal regulations exist for the control of trichinosis in fresh pork, which may represent up to 35% of total pork sales (*11*). The general decline in the annual incidence of trichinosis over the last thirty years can be attributed in part to several factors: 1) laws which prohibit feeding untreated garbage to swine (*2*), 2) consumer awareness of the need to cook pork adequately, and 3) the widespread practice of freezing pork, which will kill trichinae (*7*). The inadequacy of these measures to eliminate trichinosis entirely is evident. State and federal laws (such as the Swine Health Protection Act, 1980) prohibiting the feeding of untreated garbage to swine are irregularly enforced, which might allow pigs that have been fed untreated garbage to be sold commercially. Moreover, the widespread incidence of *Trichinella* sp. in wild animals provides a large reservoir for infection of swine (*12*). It has been shown by Murrell and others, in 1984, that pigs will readily consume barnyard rodents which may harbor *Trichinella* sp., and may become infected in that manner (*13*). Furthermore, not all consumers are aware of ways to prevent trichinosis by the proper handling of pork. Many recent immigrants are unaware of the need to thoroughly cook, freeze, or treat

TABLE 4. *Trichinella* sp. serology and muscle biopsy test results, 1983

Serology	Muscle biopsy			
	Positive	Negative	Not done	Total
Positive	5	4	12	21
Negative	2	0	2	4
Not done	2	0	0	2
Unknown	3	0	0	3
Total	12	4	14	30

American pork (procedures which may have been unnecessary in their homelands if pork there was actively inspected for trichinae). Moreover, particular ethnic preferences concerning consumption of raw pork make these groups at higher risk for infection with *Trichinella* sp. than the general population. Recent trichinosis outbreaks involving Italian and Indochinese groups support these observations (*14,15*).

In summary, the low number of cases of trichinosis in 1983 may not indicate the end of *Trichinella* sp. as a public health problem. Specific actions such as pork inspection are needed to deal with control of the disease on a national level. Of note, several states, such as Illinois, are developing legislation to eliminate trichinosis in swine and the National Pork Producers Council is developing a national strategy for the control of trichinosis. This strategy includes development of procedures for rapid, practical inspection of hogs at slaughter, investigation of new means such as irradiation to render trichinous pork noninfective, and consumer and producer education. It is hoped that initiatives such as these will lead to the elimination of trichinosis in humans and swine.

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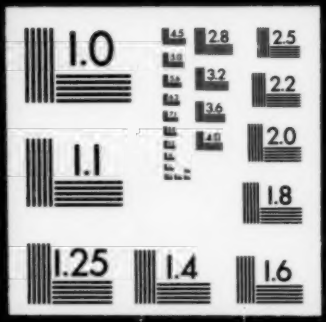
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